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ENVIRONMENTAL PROTECTION AGENCY

6560-50-P

40 CFR Part 82

[EPA-HQ-OAR-2003-0118; FRL-xxxx-x]

RIN 2060-AG12

Protection of Stratospheric Ozone: Determination 35 for Significant New Alternatives

Policy Program

AGENCY: Environmental Protection Agency (EPA).

ACTION: Determination of acceptability.

SUMMARY: This determination of acceptability expands the list of acceptable substitutes pursuant to the U.S. Environmental Protection Agency's (EPA) Significant New Alternatives Policy (SNAP) program. This action lists as acceptable additional substitutes for use in the refrigeration and air conditioning sector.

DATES: This determination is applicable on **[Insert date of publication in the Federal Register]**.

ADDRESSES: The EPA established a docket for this action under Docket ID No. EPA-HQ-OAR-2003-0118 (continuation of Air Docket A-91-42). All electronic documents in the docket are listed in the index at www.regulations.gov. Although listed in the index, some information is not publicly available, i.e., Confidential Business Information (CBI) or other information whose

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disclosure is restricted by statute. Publicly available docket materials are available either electronically at www.regulations.gov or in hard copy at the EPA Air Docket (Nos. A-91-42 and EPA-HQ-OAR-2003-0118), EPA Docket Center (EPA/DC), William J. Clinton West, Room 3334, 1301 Constitution Avenue, NW, Washington, DC 20460. The Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Public Reading Room is (202) 566-1744, and the telephone number for the Air Docket is (202) 566-1742.

FOR FURTHER INFORMATION, CONTACT: Gerald Wozniak by telephone at (202) 343-9624, by e-mail at wozniak.gerald@epa.gov, or by mail at U.S. Environmental Protection Agency, Mail Code 6205T, 1200 Pennsylvania Avenue, NW, Washington, DC 20460. Overnight or courier deliveries should be sent to the office location at 1201 Constitution Avenue, NW, Washington, DC 20004.

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II. Clarification of Refrigerated Transport—Refrigerated Trucks and Trailers End-Use Category

Appendix A: Summary of Decisions for New Acceptable Substitutes

I. Listing of New Acceptable Substitutes: Refrigeration and Air Conditioning

This action list as acceptable additional substitutes for use in several end-uses in the refrigeration and air conditioning sector.

- R-1224yd(Z) in centrifugal and positive displacement chillers and industrial process refrigeration (new and retrofit);
- R-407H in multiple refrigeration and air conditioning end-uses;
- R-448A in ice skating rinks (new equipment);
- R-449A in ice skating rinks (new equipment);
- R-449B in ice skating rinks (new equipment); and
- R-453A in refrigerated transport (new and retrofit).

EPA's review of certain substitutes listed in this document is pending for other uses.

Listing in the end-uses and applications in this document does not prejudge EPA's listings of these substitutes for other end-uses. The substitutes being added through this document to the acceptable lists for specific end-uses have a similar or lower risk than other substitutes already listed as acceptable in those end-uses. However, certain substitutes may have a higher overall risk than certain other substitutes already listed as acceptable or acceptable subject to restrictions.

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In such cases, those already-listed alternatives have not yet prove feasible in those specific end-uses.

For additional information on SNAP, visit the SNAP portion of EPA's Ozone Layer Protection website at: www.epa.gov/snap. Copies of the full lists of acceptable substitutes for ozone-depleting substances (ODS) in all industrial sectors are available at www.epa.gov/snap/substitutes-sector. For more information on the Agency's process for administering the SNAP program or criteria for evaluation of substitutes, refer to the initial SNAP rulemaking published March 18, 1994 (59 FR 13044), codified at 40 CFR part 82, subpart G. SNAP decisions and the appropriate Federal Register citations are found at: www.epa.gov/snap/snap-regulations. Substitutes listed as unacceptable; acceptable, subject to narrowed use limits; or acceptable, subject to use conditions are also listed in the appendices to 40 CFR part 82, subpart G.

The sections below discuss each substitute listing in detail. Appendix A contains tables summarizing each listing decision in this action. The statements in the "Further Information" column in the tables provide additional information but these are not legally binding under section 612 of the Clean Air Act (CAA). Although you are not required to follow recommendations in the "Further Information" column of the table to use a substitute consistent with section 612 of the CAA, some of these statements may refer to obligations that are enforceable or binding under federal or state programs other than the SNAP program. The identification of other enforceable or binding requirements should not be construed as a comprehensive list of such obligations. In many instances, the information simply refers to

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standard operating practices in existing industry standards and/or building codes. When using these substitutes in the identified end-use, EPA strongly encourages you to apply the information in the “Further Information” column. Many of these recommendations, if adopted, would not require significant changes to existing operating practices.

You can find submissions to EPA for the substitutes listed in this document, as well as other materials supporting the decisions in this action, in Docket EPA-HQ-OAR-2003-0118 at www.regulations.gov.

A. R-1224yd(Z)

EPA’s decision: EPA finds R-1224yd(Z) acceptable as a substitute for use in:

- Centrifugal chillers (new and retrofit equipment)
- Positive displacement chillers (new and retrofit equipment)
- Industrial process refrigeration (new and retrofit equipment)

R-1224yd(Z), marketed under the trade name AMOLEA™ yd, is also known as (Z)-1-chloro-2,3,3,3-tetrafluoropropene or HCFO-1224yd(Z) (Chemical Abstracts Service Registry Number [CAS Reg. No.] 111512-60-8).

You may find the redacted submission in Docket EPA-HQ-OAR-2003-0118 at www.regulations.gov under the name, “Supporting Materials for Notice 35 Listing of R-1224yd(Z) in Refrigeration and Air Conditioning. SNAP Submission Received May 12, 2017.” EPA performed assessments to examine the health and environmental risks of this substitute. These assessments are available in Docket EPA-HQ-OAR-2003-0118:

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- “Risk Screen on Substitutes in Centrifugal and Positive Displacement Chillers.

Substitute: R-1224yd(Z)”

- “Risk Screen on Substitutes in Industrial Process Refrigeration. Substitute: R-1224yd(Z)”

Environmental information: The submitter indicates that according to the National Institute of Advanced Industrial Science and Technology (AIST) of Japan R-1224yd(Z) has an ozone depletion potential (ODP) of approximately 0.00012 and a 100-year integrated global warming potential (GWP)¹ of about 1.² R-1224yd(Z) is a very short-lived substance with an atmospheric lifetime of approximately 20 days.³ The ODP of R-1224yd(Z) is significantly less than the ODPs for the ODS subject to the phase out of production and consumption under regulations issued under sections 601-607 of the CAA and consistent with *Montreal Protocol on Substances that Deplete the Ozone Layer*. Under CAA regulations (see 40 CFR 51.100(s)) defining volatile organic compounds (VOC) for the purpose of addressing the development of state implementation plans (SIPs) to attain and maintain the National Ambient Air Quality Standards (NAAQS), R-1224yd(Z) would be considered a VOC. That definition provides that “any compound of carbon” which “participates in atmospheric photochemical reactions” is considered a VOC unless expressly excluded in that provision based on a determination of

¹ Unless otherwise stated, all GWPs in this document are 100-year values from: IPCC, 2007: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., Qin, D., Manning, M., Chen, Z., Marquis, M., Averyt, K. B., Tignor M., and Miller, H. L. (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. This document is accessible at www.ipcc.ch/publications_and_data/ar4/wg1/en/contents.html.

² AIST

³ AIST

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“negligible photochemical reactivity.” Knowingly venting or releasing this refrigerant blend is limited by the venting prohibition under section 608(c)(2) of the CAA, codified at 40 CFR 82.154(a)(1). This substitute is subject to a Toxic Substance Control Act (TSCA) section 5(e) Consent Order and any subsequent TSCA section 5(a)(2) Significant New Use Rule (SNUR).

Flammability information: R-1224yd(Z) is not flammable.

Toxicity and exposure data: Potential health effects of exposure to this substitute include drowsiness or dizziness. The substitute may also irritate the skin or eyes or cause frostbite. The substitute could cause asphyxiation if air is displaced by vapors in a confined space. These potential health effects are common to many refrigerants.

The Workplace Environmental Exposure Limit (WEEL) committee of the Occupational Alliance for Risk Science (OARS) recommends a WEEL for the workplace of 1,000 ppm on an eight-hour time-weighted average (8-hr TWA) for R-1224yd(Z). EPA anticipates that users will be able to meet the WEEL and address potential health risks by following requirements and recommendations in the manufacturer’s safety data sheet (SDS), in American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 15, and other safety precautions common to the refrigeration and air conditioning industry.

Comparison to other substitutes in these end-uses: R-1224yd(Z) has an ODP of 0.00012, comparable to or less than other listed substitutes in these end-uses, with ODPs ranging from zero to 0.098.⁴

⁴ Unless otherwise stated, all ODPs in this document are from EPA’s regulations at appendix A to subpart A of 40 CFR part 82.

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For centrifugal and positive displacement chillers, R-1224yd(Z)'s GWP of about 1 is comparable to or lower than that of other acceptable substitutes such as, for new chillers, ammonia absorption, carbon dioxide (CO₂), and hydrofluoroolefin (HFO)-1336mzz(Z), and for new and retrofit chillers, R-450A and R-513A, with GWPs ranging from 0 to 630.

For industrial process refrigeration, R-1224yd(Z)'s GWP of about 1 is comparable to or lower than that of other acceptable substitutes such as, for new equipment, ammonia absorption, and for new and retrofit equipment, CO₂, R-450A, R-513A and hydrofluorocarbon (HFC)-23, with GWPs ranging from 0 to 14,800.

Flammability and toxicity risks are comparable to or lower than flammability and toxicity risks of other available substitutes in the same end-uses. Toxicity risks can be minimized by use consistent with the OARS WEEL, ASHRAE 15, and other industry standards, recommendations in the manufacturer's SDS, and other safety precautions common in the refrigeration and air conditioning industry.

EPA finds R-1224yd(Z) acceptable in the end-uses listed above because it does not pose greater overall environmental and human health risk than other available substitutes in the centrifugal and positive displacement chillers and industrial process refrigeration end-uses.

B. R-407H

EPA's decision: EPA finds R-407H acceptable as a substitute for use in:

- Retail food refrigeration—supermarket systems (new and retrofit equipment)
- Retail food refrigeration—refrigerated food processing and dispensing equipment (new and retrofit equipment)

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- Refrigerated transport—refrigerated trucks and trailers⁵ (new and retrofit equipment)

R-407H, marketed under the trade name D407, is a weighted blend of 52.5 percent HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); 32.5 percent HFC-32, which is also known as difluoromethane (CAS Reg. No. 75-10-5); and 15 percent HFC-125, which is also known as 1,1,1,2,2-pentafluoroethane (CAS Reg. No. 354-33-6).

You may find the redacted submission in Docket EPA-HQ-OAR-2003-0118 at www.regulations.gov under the name, “Supporting Documentation for Notice 33 Listing of R-407H in Refrigeration and Air Conditioning. SNAP Submission Received January 26, 2017.” EPA performed assessments to examine the health and environmental risks of this substitute. These assessments are available in Docket EPA-HQ-OAR-2003-0118:

- “Risk Screen on Substitutes in Retail Food Refrigeration Substitute: R-407H”
- “Risk Screen on Substitutes in Refrigerated Transport Substitute: R-407H”

EPA previously listed R-407H as an acceptable refrigerant in retail food refrigeration—remote condensing units (July 21, 2017, 82 FR 33809).

Environmental information: R-407H has an ODP of zero. Its components, HFC-134a, HFC-32, and HFC-125, have GWPs of 1,430; 675; and 3,500, respectively. If these values are weighted by mass percentage, then R-407H has a GWP of about 1,500. The components of R-407H are excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain NAAQS. Knowingly venting or

⁵ See Section II for clarification of this end-use.

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releasing this refrigerant blend is limited by the venting prohibition under section 608(c)(2) of the CAA, codified at 40 CFR 82.154(a)(1).

Flammability information: R-407H, as formulated and even considering the worst-case fractionation for flammability, is not flammable.

Toxicity and exposure data: Potential health effects of exposure to this substitute include drowsiness or dizziness. The substitute may also irritate the skin or eyes or cause frostbite. At sufficiently high concentrations, the substitute may cause irregular heartbeat. The substitute could cause asphyxiation if air is displaced by vapors in a confined space. These potential health effects are common to many refrigerants.

The American Industrial Hygiene Association (AIHA) has established WEELs of 1,000 ppm as an 8-hr TWA for HFC-134a, HFC-32, and HFC-125, the components of R-407H. The manufacturer of R-407H recommends an acceptable exposure limit (AEL) of 1,000 ppm on an 8-hr TWA for the blend. EPA anticipates that users will be able to meet each of the AIHA WEELs and the manufacturer's AEL and address potential health risks by following requirements and recommendations in the manufacturer's SDS, in ASHRAE 15, and other safety precautions common to the refrigeration and air conditioning industry.

Comparison to other substitutes in these end-uses: R-407H has an ODP of zero, comparable to or lower than the other listed substitutes in these end-uses, with ODPs ranging from zero to 0.098.

R-407H's GWP of 1,500 is lower than or comparable to that of acceptable substitutes for retail food refrigeration--refrigerated food processing and dispensing equipment (new and

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retrofit), such as a number of HFC blends with GWPs in the range of 1,500 to 1,700. The GWP of R-407H is higher than the GWPs of other acceptable substitutes for retail food refrigeration--refrigerated food processing and dispensing equipment (new and retrofit), including CO₂, R-450A, and R-513A with GWPs ranging from one to 630.

R-407H's GWP of 1,500 is lower than or comparable to that of acceptable substitutes for retail food refrigeration—supermarket systems (new and retrofit), such as a number of HFC blends with GWPs in the range of 1,500 to 2,630. The GWP of R-407H is higher than the GWPs of other acceptable substitutes for retail food refrigeration—supermarket systems (new and retrofit), including CO₂, R-450A, and R-513A with GWPs ranging from one to 630.

R-407H's GWP of 1,500 is lower than or comparable to that of acceptable substitutes for refrigerated transport—refrigerated trucks and trailers such as R-404A, R-507A, and a number of HFC refrigerant blends with GWPs in the range of 1,500 to 3,990. R-407H's GWP is higher than the GWPs of other acceptable substitutes for refrigerated transport—refrigerated trucks and trailers, including ammonia absorption, CO₂, R-450A, and R-513A with GWPs ranging from zero to 630. Flammability and toxicity risks are comparable to or lower than flammability and toxicity risks of other available substitutes in the same end-uses. Toxicity risks can be minimized by use consistent with the AIHA WEELs, ASHRAE 15 and other industry standards, recommendations in the manufacturer's SDS, and other safety precautions common in the refrigeration and air conditioning industry.

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EPA finds R-407H acceptable in the end-uses listed above because it does not pose greater overall environmental and human health risk than other available substitutes in the same end-uses.

C. R-448A

EPA's decision: EPA finds R-448A acceptable as a substitute for use in:

- Ice skating rinks (new equipment)

R-448A, marketed under the trade name Solstice[®] N-40, is a weighted blend of 26 percent HFC-32, which is also known as difluoromethane (CAS Reg. No. 75-10-5); 26 percent HFC-125, which is also known as 1,1,1,2,2-pentafluoroethane (CAS Reg. No. 354-33-6); 21 percent HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); 20 percent HFO-1234yf, which is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754-12-1); and seven percent HFO-1234ze(E), which is also known as *trans*-1,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 29118-24-9). You may find the redacted submission in Docket EPA-HQ-OAR-2003-0118 at www.regulations.gov under the name, "Supporting Documentation for Notice 30 Listing of R-448A (N-40) in Certain Refrigeration and Air Conditioning End-Uses Submission Received May 29, 2014." EPA performed an assessment to examine the health and environmental risks of this substitute. This assessment is available in Docket EPA-HQ-OAR-2003-0118 "Risk Screen on Substitutes in Ice Skating Rinks (New Equipment) Substitute: R-448A."

EPA previously listed R-448A as an acceptable refrigerant in a number of other refrigeration and air conditioning end-uses, including retrofit use in ice skating rinks (e.g., July

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16, 2015, 80 FR 42053; October 11, 2016, 81 FR 70029; July 21, 2017, 82 FR 33809; October 4, 2018, 83 FR 50026).

Environmental information: R-448A has an ODP of zero. Its components, HFC-32, HFC-125, HFC-134a, HFO-1234yf, and HFO-1234ze(E) have GWPs of 675; 3,500; 1,430; one to four;^{6,7} and one to six;⁸ respectively. If these values are weighted by mass percentage, then R-448A has a GWP of about 1,390. The components of R-448A are excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS. Knowingly venting or releasing this refrigerant blend is limited by the venting prohibition under section 608(c)(2) of the CAA, codified at 40 CFR 82.154(a)(1).

Flammability information: R-448A, as formulated and even considering the worst-case fractionation for flammability, is not flammable.

Toxicity and exposure data: Potential health effects of exposure to this substitute include drowsiness or dizziness. The substitute may also irritate the skin or eyes or cause frostbite. At sufficiently high concentrations, the substitute may cause irregular heartbeat. The substitute could cause asphyxiation if air is displaced by vapors in a confined space. These potential health effects are common to many refrigerants.

⁶ Hodnebrog Ø., Etminan, M., Fuglestad, J.S., Marston, G., Myhre, G., Nielsen, C.J., Shine, K.P., Wallington, T.J.: Global Warming Potentials and Radiative Efficiencies of Halocarbons and Related Compounds: A Comprehensive Review, *Reviews of Geophysics*, 51, 300–378, doi:10.1002/rog.20013, 2013

⁷ Nielsen, O. J., Javadi, M. S., Sulbaek Andersen, M. P., Hurley, M. D., Wallington, T. J., Singh, R. Atmospheric chemistry of CF₃CF=CH₂: Kinetics and mechanisms of gas-phase reactions with Cl atoms, OH radicals, and O₃. *Chemical Physics Letters* 439, 18-22, 2007.

⁸ Hodnebrog *et al.*, 2013 and Atmospheric chemistry of trans-CF₃CH=CHF: products and mechanisms of hydroxyl radical and chlorine atom initiated oxidation'', M.S. Javadi, R. Søndergaard, O.J. Nielsen, M.D., Hurley, and T.J. Wellington, *Atmospheric Chemistry and Physics Discussions* 8, 1069–1088, 2008.

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The AIHA has established WEELs of 1,000 ppm as an 8-hr TWA for HFC-32, HFC-125, and HFC-134a; 500 ppm for HFO-1234yf; and 800 ppm for HFO-1234ze(E), the components of R-448A. The manufacturer of R-448A recommends an AEL of 890 ppm on an 8-hr TWA for the blend. EPA anticipates that users will be able to meet the AIHA WEELs and manufacturer's AEL and address potential health risks by following requirements and recommendations in the manufacturer's SDS, in ASHRAE 15, and other safety precautions common to the refrigeration and air conditioning industry.

Comparison to other substitutes in this end-use: R-448A has an ODP of zero, comparable to or lower than other listed substitutes in this end-use, with ODPs ranging from zero to 0.098.

R-448A's GWP of 1,390 is lower than or comparable to that of acceptable substitutes for ice skating rinks (new), such as HFC-134a, R-407C, and R-507A, with GWPs ranging from 1,430 to 3,990. R-448A's GWP is higher than the GWPs of other acceptable substitutes for ice skating rinks (new), including ammonia absorption, CO₂, R-450A, and R-513A with GWPs ranging from zero to 630.

Flammability and toxicity risks are comparable to or lower than flammability and toxicity risks of other available substitutes in the same end-use. Toxicity risks can be minimized by use consistent with the AIHA WEELs, ASHRAE 15 and other industry standards, recommendations in the manufacturer's SDS, and other safety precautions common in the refrigeration and air conditioning industry.

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EPA finds R-448A acceptable in the ice skating rinks (new) end-use because it does not pose greater overall environmental and human health risk than other available substitutes in this end-use.

D. R-449A

EPA's decision: EPA finds R-449A acceptable as a substitute for use in:

- Ice skating rinks (new equipment)

R-449A, marketed under the trade name Opteon[®] XP 40, is a weighted blend of 24.3 percent HFC-32, which is also known as difluoromethane (CAS Reg. No. 75-10-5); 24.7 percent HFC-125, which is also known as 1,1,1,2,2-pentafluoroethane (CAS Reg. No. 354-33-6); 25.7 percent HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); and 25.3 percent HFO-1234yf, which is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754-12-1).

You may find the redacted submission in Docket EPA-HQ-OAR-2003-0118 at www.regulations.gov under the name, “Supporting Documentation for Notice 30 Listing of R-449A (XP40) in Certain Refrigeration and Air Conditioning End-Uses. SNAP Submission Received August 6, 2014.” EPA performed an assessment to examine the health and environmental risks of this substitute. This assessment is available in Docket EPA-HQ-OAR-2003-0118 “Risk Screen on Substitutes in Ice Skating Rinks (New Equipment) Substitute: R-449A.”

EPA previously listed R-449A as an acceptable refrigerant in a number of other refrigeration and air conditioning end-uses, including retrofit use in ice skating rinks (e.g., July

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16, 2015, 80 FR 42053; October 11, 2016, 81 FR 70029; July 21, 2017, 82 FR 33809; October 4, 2018, 83 FR 50026).

Environmental information: R-449A has an ODP of zero. Its components, HFC-32, HFC-125, HFC-134a, and HFO-1234yf, have GWPs of 675; 3,500; 1,430; and one to four,⁹ respectively. If these values are weighted by mass percentage, then R-449A has a GWP of about 1,400. The components of R-449A are excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS. Knowingly venting or releasing this refrigerant blend is limited by the venting prohibition under section 608(c)(2) of the CAA, codified at 40 CFR 82.154(a)(1).

Flammability information: R-449A, as formulated and even considering the worst-case fractionation for flammability, is not flammable.

Toxicity and exposure data: Potential health effects of exposure to this substitute include drowsiness or dizziness. The substitute may also irritate the skin or eyes or cause frostbite. At sufficiently high concentrations, the substitute may cause irregular heartbeat. The substitute could cause asphyxiation if air is displaced by vapors in a confined space. These potential health effects are common to many refrigerants.

The AIHA has established WEELs of 1,000 ppm as an 8-hr TWA for HFC-32, HFC-125, and HFC-134a and 500 ppm for HFO-1234yf, the components of R-449A. The manufacturer of R-449A recommends an AEL of 830 ppm on an 8-hr TWA for the blend. EPA anticipates that

⁹ Hodnebrog *et al.*, 2013 and Nielsen *et al.*, 2007. *Op. cit.*

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users will be able to meet each of the AIHA WEELs and the manufacturer's AEL and address potential health risks by following requirements and recommendations in the manufacturer's SDS, in ASHRAE 15, and other safety precautions common to the refrigeration and air conditioning industry.

Comparison to other substitutes in this end-use: R-449A has an ODP of zero, comparable to or lower than the other listed substitutes in this end-use, with ODPs ranging from zero to 0.098.

R-449A's GWP of 1,400 is lower than or comparable to that of acceptable substitutes for ice skating rinks (new), such as HFC-134a, R-407C, and R-507A with GWPs ranging from 1,430 to 3,990. R-449A's GWP is higher than the GWPs of other acceptable substitutes for ice skating rinks (new), including ammonia absorption, CO₂, R-450A, and R-513A with GWPs ranging from zero to 630.

Flammability and toxicity risks are comparable to or lower than flammability and toxicity risks of other available substitutes in the same end-use. Toxicity risks can be minimized by use consistent with the AIHA WEELs, ASHRAE 15 and other industry standards, recommendations in the manufacturer's SDS, and other safety precautions common in the refrigeration and air conditioning industry.

EPA finds R-449A acceptable in the ice skating rinks (new) end-use because it does not pose greater overall environmental and human health risk than other available substitutes in the same end-use.

E. R-449B

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EPA's decision: EPA finds R-449B acceptable as a substitute for use in:

- Ice skating rinks (new equipment)

R-449B, marketed under the trade name Forane[®] 449B, is a weighted blend of 25.2 percent HFC-32, which is also known as difluoromethane (CAS Reg. No. 75-10-5); 24.3 percent HFC-125, which is also known as 1,1,1,2,2-pentafluoroethane (CAS Reg. No. 354-33-6); 27.3 percent HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); and 23.2 percent HFO-1234yf, which is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754-12-1).

You may find the redacted submission in Docket EPA-HQ-OAR-2003-0118 at www.regulations.gov under the name, "Supporting Documentation for Notice 32 Listing of R-449B in Refrigeration and Air Conditioning. SNAP Submission Received October 2, 2015." EPA performed an assessment to examine the health and environmental risks of this substitute. This assessment is available in Docket EPA-HQ-OAR-2003-0118 "Risk Screen on Substitutes in Ice Skating Rinks (New Equipment) Substitute: R-449B."

EPA previously listed R-449B as an acceptable refrigerant in a number of other refrigeration and air conditioning end-uses, including retrofit use in ice skating rinks (e.g., October 11, 2016, 81 FR 70029; July 21, 2017, 82 FR 33809; October 4, 2018, 83 FR 50026).

Environmental information: R-449B has an ODP of zero. Its components, HFC-32, HFC-125, HFC-134a, and HFO-1234yf, have GWPs of 675; 3,500; 1,430; and one to four,¹⁰

¹⁰ Hodnebrog *et al.*, 2013 and Nielsen *et al.*, 2007. *Op. cit.*

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respectively. If these values are weighted by mass percentage, then R-449B has a GWP of about 1,410. The components of R-449B are excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS. Knowingly venting or releasing this refrigerant blend is limited by the venting prohibition under section 608(c)(2) of the CAA, codified at 40 CFR 82.154(a)(1).

Flammability information: R-449B, as formulated and even considering the worst-case fractionation for flammability, is not flammable.

Toxicity and exposure data: Potential health effects of exposure to this substitute include drowsiness or dizziness. The substitute may also irritate the skin or eyes or cause frostbite. At sufficiently high concentrations, the substitute may cause irregular heartbeat. The substitute could cause asphyxiation if air is displaced by vapors in a confined space. These potential health effects are common to many refrigerants.

The AIHA has established WEELs of 1,000 ppm as an 8-hr TWA for HFC-32, HFC-125, and HFC-134a and 500 ppm for HFO-1234yf, the components of R-449B. The manufacturer of R-449B recommends an AEL of 865 ppm on an 8-hr TWA for the blend. EPA anticipates that users will be able to meet each of the AIHA WEELs and the manufacturer's AEL and address potential health risks by following requirements and recommendations in the manufacturer's SDS, in ASHRAE 15, and other safety precautions common to the refrigeration and air conditioning industry.

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Comparison to other substitutes in this end-use: R-449B has an ODP of zero, comparable to or lower than the other listed substitutes in this end-use, with ODPs ranging from zero to 0.098.

R-449B's GWP of 1,410 is lower than or comparable to that of acceptable substitutes for ice skating rinks (new), such as HFC-134a, R-407C, and R-507A with GWPs ranging from 1,430 to 3,990. R-449B's GWP is higher than the GWPs of other acceptable substitutes for ice skating rinks (new), including ammonia absorption, CO₂, R-450A, and R-513A with GWPs ranging from zero to 630.

Flammability and toxicity risks are comparable to or lower than flammability and toxicity risks of other available substitutes in the same end-use. Toxicity risks can be minimized by use consistent with the AIHA WEELs, ASHRAE 15 and other industry standards, recommendations in the manufacturer's SDS, and other safety precautions common in the refrigeration and air conditioning industry.

EPA finds R-449B acceptable in the ice skating rinks (new) end-use because it does not pose greater overall environmental and human health risk than other available substitutes in this end-use.

F. R-453A

EPA's decision: EPA finds R-453A acceptable as a substitute for use in:

- Refrigerated transport—refrigerated trucks and trailers ¹¹(new and retrofit equipment)

¹¹ See Section II for clarification of this end-use.

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R-453A, marketed under the trade name RS-70, is a weighted blend of 53.8 percent HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); 20.0 percent HFC-32, which is also known as difluoromethane (CAS Reg. No. 75-10-5); and 20 percent HFC-125, which is also known as 1,1,1,2,2-pentafluoroethane (CAS Reg. No. 354-33-6); five percent HFC-227ea, which is also known as 1,1,1,2,3,3,3-heptafluoropropane (CAS Reg. No. 75-28-5); 0.6 percent R-600, which is also known as butane (CAS Reg. No. 75-28-5); and 0.6 percent R-601a, which is also known as isopentane (CAS Reg. No. 78-78-4).

You may find the redacted submission in Docket EPA-HQ-OAR-2003-0118 at www.regulations.gov under the name, “Supporting Documentation for Notice 33 Listing of R-453A in Refrigeration and Air Conditioning. SNAP Submission Received March 12, 2015.” EPA performed an assessment to examine the health and environmental risks of this substitute. This assessment is available in Docket EPA-HQ-OAR-2003-0118 “Risk Screen on Substitutes in Refrigerated Transport—Substitute: R-453A.”

EPA previously listed R-453A as an acceptable refrigerant in a number of other refrigeration and air conditioning end-uses, including use in retail food refrigeration—remote condensing units, industrial process refrigeration, and cold storage warehouses (July 21, 2017, 82 FR 33809).

Environmental information: R-453A has an ODP of zero. Its components, HFC-134a, HFC-32, HFC-125, HFC-227ea, butane, and isopentane have GWPs of 1,430; 675; 3,500; 3,220; 4; and 5, respectively. If these values are weighted by mass percentage, then R-453A has a GWP of about 1,770. Except for butane and isopentane, which together make up 1.2 percent of the

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blend, the components of R-453A are excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS.¹² Knowingly venting or releasing this refrigerant blend is limited by the venting prohibition under section 608(c)(2) of the CAA, codified at 40 CFR 82.154(a)(1).

Flammability information: R-453A, as formulated and even considering the worst-case fractionation for flammability, is not flammable.

Toxicity and exposure data: Potential health effects of exposure to this substitute include drowsiness or dizziness. The substitute may also irritate the skin or eyes or cause frostbite. At sufficiently high concentrations, the substitute may cause irregular heartbeat. The substitute could cause asphyxiation if air is displaced by vapors in a confined space. These potential health effects are common to many refrigerants.

For the components of R-453A, AIHA has established WEELs of 1,000 ppm as an 8-hr TWA for HFC-134a, HFC-32, HFC-125, and HFC-227ea, and the American Conference of Governmental Industrial Hygienists (ACGIH) has established a Threshold Limit Value (TLV) of 1,000 ppm for R-600 and a TLV of 600 ppm for R-601a, both as an 8-hr TWA. The manufacturer of R-453A recommends an AEL of 1,000 ppm on an 8-hr TWA for the blend. EPA anticipates that users will be able to meet each of the AIHA WEELs, the ACGIH's TLVs, and the manufacturer's AEL and address potential health risks by following requirements and

¹² EPA's analysis of the local air quality impacts of potential emissions of HCs when used as refrigerant substitutes in all end-uses in the refrigeration and AC sector estimated that saturated HCs, such as butane and isopentane, have little impact on local air quality. 81 FR at 86792; December 1, 2016.

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recommendations in the manufacturer's SDS, in ASHRAE 15, and other safety precautions common to the refrigeration and air conditioning industry.

Comparison to other substitutes in this end-use: R-453A has an ODP of zero, comparable to or lower than the other listed substitutes in this end-use, with ODPs ranging from zero to 0.098.

R-453A's GWP of 1,770 is lower than or comparable to that of acceptable substitutes for refrigerated transport—refrigerated trucks and trailers such as R-404A, R-507A, and a number of HFC refrigerant blends with GWPs in the range of 1,770 to 3,990. R-453A's GWP is higher than the GWPs of other acceptable substitutes for refrigerated transport—refrigerated trucks and trailers, including ammonia absorption, CO₂, R-450A, and R-513A with GWPs ranging from zero to 630.

Flammability and toxicity risks are comparable to or lower than flammability and toxicity risks of other available substitutes in the same end-uses. Toxicity risks can be minimized by use consistent with the AIHA WEELs, ASHRAE 15 and other industry standards, recommendations in the manufacturer's SDS, and other safety precautions common in the refrigeration and air conditioning industry.

EPA finds R-453A acceptable in the refrigerated transport—refrigerated trucks and trailers end-use because it does not pose greater overall environmental and human health risk than other available substitutes in this end-use.

II. Clarification of Refrigerated Transport—Refrigerated Trucks and Trailers End-Use Category

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In this action, EPA is listing multiple refrigerants as acceptable substitutes in the “refrigerated transport – refrigerated trucks and trailers” end-use category. EPA first introduced this end-use category in prior listings for the refrigerants R-452A and R-452C (July 21, 2017, 82 FR 33809). In response to a request for clarification, we are providing a more thorough description of the types of equipment included in the refrigerated transport—refrigerated trucks and trailers end-use category. As previously specified, this end-use category covers a subset of on-road vehicles, i.e., refrigerated trucks and trailers with a separate autonomous refrigeration unit with the condenser typically located at the front of a refrigerated trailer. This end-use category also covers domestic trailer refrigeration units that contain an integrated motor (i.e., does not require a separate electrical power system or separate generator set to operate) that are transported as part of a truck, on truck trailers, and on railway flat cars. Other types of containers, such as sea-going ones that are connected to a ship’s electrical system or require a separate generator that is not an integral part of the refrigeration unit to operate, are not included. This end-use category also does not include (i) refrigerated vans or other vehicles where a single system also supplies passenger comfort cooling, (ii) refrigerated containers that are less than 8 feet 4 inches in width, (iii) refrigeration units used on containers that require a separate generator to power the refrigeration unit, or (iv) ship holds.

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List of Subjects in 40 CFR Part 82

Environmental protection, Administrative practice and procedure, Air pollution control,
Reporting and recordkeeping requirements.

Dated: _____

Christopher Grundler, Director
Office of Atmospheric Programs

APPENDIX A: SUMMARY OF DECISIONS FOR NEW ACCEPTABLE SUBSTITUTES

Refrigeration and Air Conditioning

End-Use	Substitute	Decision	Further Information ¹
Centrifugal chillers (<i>new and retrofit equipment</i>)	R-1224yd(Z)	Acceptable	<p>R-1224yd(Z) has an ozone depletion potential (ODP) of approximately 0.00012 and a 100-yr global warming potential (GWP) of approximately 1. R-1224yd(Z) is also known as (Z)-1-chloro-2,3,3,3-tetrafluoropropene (CAS Reg. No. 111512-60-8).</p> <p>R-1224yd(Z) is not flammable.</p> <p>The Occupational Alliance for Risk Science (OARS) recommends a Workplace Environmental Exposure Limit (WEEL) of 1,000 ppm on an eight-hour time-weighted average (8-hr TWA) for R-1224yd(Z).</p>
Ice skating rinks (<i>new equipment</i>).	R-448A	Acceptable	<p>R-448A has a 100-yr GWP of approximately 1,390. This substitute is a blend of HFC-32 which is also known as difluoromethane (CAS Reg. No. 75-10-5); HFC-125, which is also known as 1,1,1,2,2-pentafluoroethane (CAS Reg. No. 354-33-6); HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); HFO-1234yf, which is also known as 2,3,3,3-tetrafluoro-prop-1-ene (CAS Reg. No. 754-12-1); and HFO-1234ze(E) which is also known as <i>trans</i>-1,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 29118-24-9).</p> <p>The blend is nonflammable.</p> <p>The American Industrial Hygiene Association (AIHA) has established WEELs of 1,000 ppm on an 8-hr TWA basis for HFC-32, HFC-125, and HFC-134a; 500 ppm for HFO-1234yf; and 800 ppm for HFO-1234ze(E). The manufacturer recommends an acceptable exposure limit (AEL) for the workplace for R-448A of 890 ppm (8-hr TWA).</p>

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End-Use	Substitute	Decision	Further Information ¹
Ice skating rinks (<i>new equipment</i>).	R-449A	Acceptable	<p>R-449A has a 100-year GWP of approximately 1,400. This substitute is a blend of HFC-32 (CAS Reg. No. 75-10-5); HFC-125 (CAS Reg. No. 354-33-6); HFC-134a (CAS Reg. No. 811-97-2); and HFO-1234yf (CAS Reg. No. 754-12-1).</p> <p>The blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm (8-hr TWA) for HFC-32, HFC-125, and HFC-134a; and 500 ppm for HFO-1234yf. The manufacturer recommends an AEL for the workplace for R-449A of 830 ppm (8-hr TWA).</p>
Ice skating rinks (<i>new equipment</i>).	R-449B	Acceptable	<p>R-449B has a 100-year GWP of approximately 1,410. This substitute is a blend of HFC-32 (CAS Reg. No. 75-10-5); HFC-125 (CAS Reg. No. 354-33-6); HFC-134a (CAS Reg. No. 811-97-2); and HFO-1234yf (CAS Reg. No. 754-12-1).</p> <p>The blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm (8-hr TWA) for HFC-32, HFC-125, and HFC-134a; and 500 ppm for HFO-1234yf. The manufacturer recommends an AEL for the workplace for R-449B of 865 ppm (8-hr TWA).</p>
Industrial process refrigeration (<i>new and retrofit equipment</i>).	R-1224yd(Z)	Acceptable	<p>R-1224yd(Z) has an ODP of approximately 0.00012 and a GWP of approximately 1. R-1224yd(Z) is also known as (Z)-1-chloro-2,3,3,3-tetrafluoropropene (CAS Reg. No. 111512-60-8).</p> <p>R-1224yd(Z) is not flammable.</p> <p>The OARS recommends a WEEL of 1,000 ppm (8-hr TWA) for R-1224yd(Z).</p>
Positive Displacement chillers (<i>new and retrofit equipment</i>).	R-1224yd(Z)	Acceptable	<p>R-1224yd(Z) has an ODP of approximately 0.00012 and a GWP of approximately 1. R-1224yd(Z) is also known as (Z)-1-chloro-2,3,3,3-tetrafluoropropene (CAS Reg. No. 111512-60-8).</p> <p>R-1224yd(Z) is not flammable.</p> <p>The OARS recommends a WEEL of 1,000 ppm (8-hr TWA) for R-1224yd(Z).</p>

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End-Use	Substitute	Decision	Further Information ¹
Refrigerated transport—refrigerated trucks and trailers (<i>new and retrofit equipment</i>).	R-407H	Acceptable	<p>R-407H has a 100-year GWP of approximately 1,500. This substitute is a blend of HFC-134a (CAS Reg. No.811-97-2); HFC-32 (CAS Reg. No. 75-10-5); and HFC-125 (CAS Reg. No. 354-33-6).</p> <p>This blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm (8-hr TWA) for HFC-134a, HFC-32, and HFC-125. The manufacture recommends an AEL for the workplace for R-407H of 1,000 ppm (8-hr TWA).</p>
Refrigerated transport—refrigerated trucks and trailers (<i>new and retrofit equipment</i>).	R-453A	Acceptable	<p>R-453A has a 100-year GWP of approximately 1,770. This substitute is a blend of HFC-32, which is also known as difluoromethane (CAS Reg. No. 75-10-5); HFC-125, which is also known as 1,1,1,2,2-pentafluoroethane (CAS Reg. No. 354-33-6); HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); HFC-227ea, which is also known as 1,1,1,2,3,3,3-heptafluoropropane (CAS Reg. No. 439-89-0); R-600, which is also known as butane (CAS Reg. No. 75-28-5); and R-601a, which is also known as isopentane (CAS Reg. No. 78-78-4).</p> <p>The blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm (8-hr TWA) for HFC-32, HFC-125, HFC-134a, and HFC-227ea, and the American Conference of Governmental Industrial Hygienists has established a Threshold Limit Value (TLV) of 1,000 ppm for R-600 and a TLV of 600 ppm for R-601a, both as an 8-hr TWA. The manufacturer recommends an AEL for the workplace for R-453A of 1,000 ppm (8-hr TWA).</p>

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End-Use	Substitute	Decision	Further Information ¹
Retail food refrigeration—refrigerated food processing and dispensing equipment (<i>new and retrofit equipment</i>).	R-407H	Acceptable	<p>R-407H has a 100-year GWP of approximately 1,500. This substitute is a blend of HFC-134a (CAS Reg. No.811-97-2); HFC-32 (CAS Reg. No. 75-10-5); and HFC-125 (CAS Reg. No. 354-33-6).</p> <p>This blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm (8-hr TWA) for HFC-134a, HFC-32, and HFC-125. The manufacture recommends an AEL for the workplace for R-407H of 1,000 ppm (8-hr TWA).</p>
Retail food refrigeration—supermarket systems (<i>new and retrofit equipment</i>).	R-407H	Acceptable	<p>R-407H has a 100-year GWP of approximately 1,500. This substitute is a blend of HFC-134a (CAS Reg. No.811-97-2); HFC-32 (CAS Reg. No. 75-10-5); and HFC-125 (CAS Reg. No. 354-33-6).</p> <p>This blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm (8-hr TWA) for HFC-134a, HFC-32, and HFC-125. The manufacture recommends an AEL for the workplace for R-407H of 1,000 ppm (8-hr TWA).</p>

¹ Observe recommendations in the manufacturer's SDS and guidance for all listed refrigerants.